

DOCUMENT RESUME

ED 151 297

SO 010 782

TITLE Energy Activities for Junior High Social Studies.
 INSTITUTION Minnesota State Energy Agency, St. Paul.
 PUB DATE Apr 77
 NOTE 36p.; Not available in hard copy from EDRS due to poor reproducibility of original document

EDRS PRICE MF-\$0.83 Plus Postage. HC Not Available from EDRS.
 DESCRIPTORS Activity Learning; *Activity Units; Community Attitudes; Consumer Education; Cultural Differences; Decision Making Skills; Educational Games; *Energy; *Energy Conservation; Environmental Education; Futures (of Society); Grade 7; Grade 8; Group Activities; Information Utilization; *Instructional Materials; Interdisciplinary Approach; Junior High School Students; Life Style; Personal Values; Problem Solving; Science Activities; Science Instruction; Science Units; Simulation; Social Problems; Social Studies; *Social Studies Units; Student Attitudes; Student Opinion; Student Reaction

ABSTRACT

The document contains seven learning activities for junior high students on the energy situation. Objectives are to help students gain understanding and knowledge about the relationships between humans and their social and physical environments; solve problems and clarify issues; examine personal beliefs and values; and recognize the relationships between beliefs, values, and individual behavior. In the first unit, "For Peat's Sake," social studies and science teachers cooperate. In these experiments the heat value of peat is compared to other materials and it is suggested that peat be used for energy production. Students collect information about the energy situation in the second unit. They play an energy game and develop a questionnaire to sample student and community opinions about energy. The third unit, "Implications," is a tool which helps students examine possibilities, complexities, interrelationships, and implications of trends and innovations. In the other four units students compare the differences energy has made in lifestyles; consider the implications of alternative living as energy conservation; discuss what they love and hate about power/energy; and explore the future in terms of their own life styles. (Author/JK)

 * Reproductions supplied by EDRS are the best that can be made *
 * from the original document. *

ED151297

SO 010 782

Energy Activities for Junior High Social Studies

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Holly Redmond

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

CONTENTS

- 1 **FOR PEAT'S SAKE:** Our future energy supplies will depend increasingly upon alternative energy resources. One of the primary alternative energy resources being considered for use in Minnesota is peat. This activity offers an opportunity for science and social studies teachers to cooperate. Experiments/demonstrations on the heat value of peat as compared to other materials and the conversion of peat to gas are suggested. Students are also supplied with some background information on the economic, social and environmental impacts of harvesting and using peat for energy production. They assess this information, write a statement that they want to present at a hearing which begins with, "I urge you to...", and then share this response.

Helps students to understand ways humans both adapt to and modify their physical environment; to develop criteria on which to judge proposed courses of action; to cooperate; to evaluate varied sources; and to cut across disciplines.

- 2 **THE CLIP/PER TRIP:** Students collect information from newspapers and magazines about the energy situation. The topics can be broad (energy) or narrow (solar, wind, peat, conservation). The information collected is monitored and evaluated for possible effects and implications. A suggested monitoring format is included. Students play an energy game which makes use of the information collected and monitored. In this game, one group, the people, define an energy problem and another group, the environment, respond with a solution. The two groups, the people and the environment, then respond with the consequences of each response. The game can be played throughout any unit on energy to help summarize energy relationships and to encourage divergent thinking. Finally, students develop an energy questionnaire which can be used to sample opinions from students and community members on energy issues.

Helps students learn to identify and classify central elements in information sources; to summarize information; to participate in decision making; to use sampling techniques; to participate in the community; to cooperate in group activities; and to organize collected information.

- 3 **IMPLICATIONS:** The implications or futures wheel is a tool which can help students examine possibilities and implications of trends and innovations. It helps students understand the complexity of trends and innovations. It emphasizes interrelationships and provides a graphic and manageable way of examining complexity.

Helps students to describe some innovations and suggest ways these innovations might affect social life and to acquire skills in examining cause and effect relationships.

- 4 **THE GOOD AULD DAYS (?):** Students compare the differences energy has made in lifestyles over the past 75 years and are encouraged to find out to what extent increased energy use has led to a more enjoyable lifestyle. The activity emphasizes the use of primary sources to find out this information. Four separate approaches (which could be combined) are suggested.

Helps students to identify and locate appropriate sources of information and to identify objects, feelings, and ideas important to people living in different times.

CONTENTS (Cont.)

- 5 ALTER/NATIVE LIVING AS ENERGY CONSERVATION: Students read case histories of people who live alternative lifestyles. Using a checklist of appliances, machines, and gadgets, students will try to decide which of these are used by the people they have read about, and which by themselves and their families. They compare lists and discuss some of the implications of alternative living as energy conservation. A cross-cultural approach is also suggested.

Helps students to understand the influence of lifestyle on consumer decisions, to compare the effect of different cultures on consumer decisions; and to describe and explain their own feelings and preferences about people, beliefs and ways of life.

- 6 THREE FOR - THREE AGAINST: Students are asked to decide what they love and hate about power/energy and in groups rank order the choices according to how they should love and hate their choices.

Promotes the examination of what students believe and value, the acceptance of majority decisions and the appreciation of diversity in others.

- 7 TOMORROW IS JUST LIKE TODAY (?): Students are encouraged to think about the future in terms of their own lifestyles and the impact future events will have on that lifestyle.

Helps students to modify proposed solutions when new or conflicting information becomes available and to describe a response to a dilemma situation.

TOMORROW IS JUST LIKE TODAY(?)



When we think about or plan for the future we almost always expect to have as many material and energy-consuming goods as we desire. And we almost never believe that what we do as individuals will have any significant effect on energy consumption trends or proliferation of waste materials or on the amount of energy available. Individuals do have a significant impact on energy use. Forty-two percent of the energy used in Minnesota is used in homes and for personal transportation. **Only**

individuals will be able to reduce that energy use.

SUM/MARY

Students are encouraged to think about the future in terms of their own lifestyles and what impact future events will have on that lifestyle.

DE/SCRIPT/ION

1. Have students list what they

think they will be doing in the future and what their life will be like. Will they have a house? A car? Land? Will they have a family? What size? Where will they go on vacation? Encourage detail. Ask them to keep their visions of their future for a few days.

2. Several days later have them predict what the future will be like, especially the energy future. More? Less? Different? In what ways? More or less expensive? Rationed? Then have them compare their predictions of

their future lifestyles with their predictions of the future. In what ways are they alike? Different? Do they expect that their individual future will be much more pleasant than society's future? What are some of their reasons?

E/VALU/ATION

1. What can a person do so that her/his future will be better? Will this make society better? What if it does not? Can people create their own future? What part of it can they control? Not control? Are you sure?
2. What is the good energy life? Break the class into groups of four and let them decide. Share the results. How alike and different are they?
3. If the class tends to have a pessimistic attitude about the future in general and an optimistic one about their personal future, what do they think this means? Is it "natural" to be pessimistic or optimistic about the future?

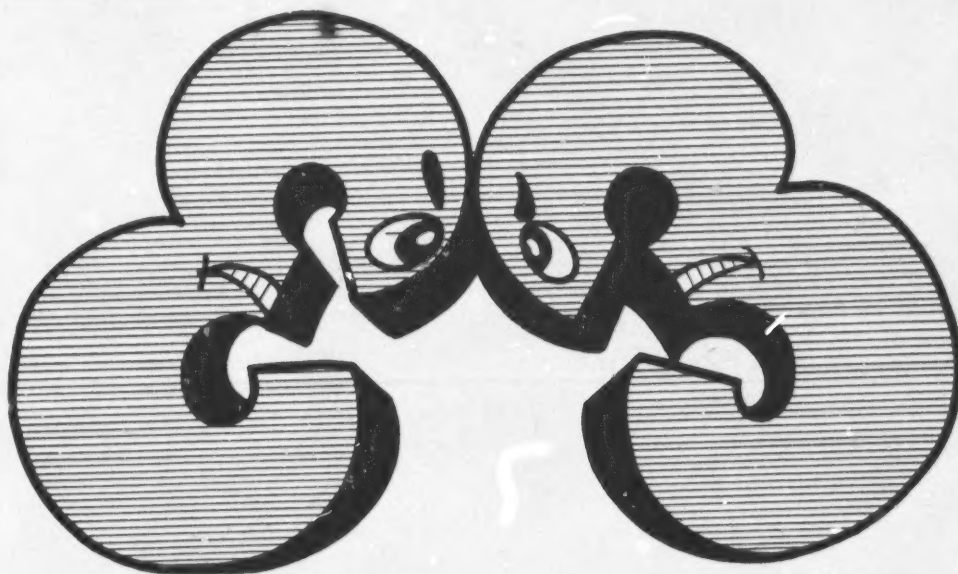
4. What can you do to change the energy situation? Now? Five years from now? Ten years from now? Will you do it?

RE/SOURCES

1975. Minnesota's Energy Situation to 1985. Minnesota Energy Agency, 740 American Center Building, 150 East Kellogg Boulevard, St. Paul, Minnesota 55101 (free)

1976. Minnesota's Energy Situation: A Biennial Report to the Governor and the Legislature. Minnesota Energy Agency, 740 American Center Building, 150 East Kellogg Boulevard, St. Paul, Minnesota 55101 (free)

THREE FOR — THREE AGAINST



We are bombarded daily by the press, by television, and by radio with the news that we face a "permanent energy crisis". Energy prices are increasing and our needs/wants appear to be outstripping our major energy resources.

There appear to be two solutions to this dilemma. We can try to increase the supply by increasing conventional resources through increased strip mining of coal, drilling of oil and gas wells, as well as tapping new sources of energy, or we can reduce the rate

of growth of energy use or possibly even decrease it.

Both of these solutions are of concern here but in an indirect way. In order to solve our energy problems, perhaps one of the things we need to know is what we like and dislike about energy power. What is it about energy and power that excites us? What is it that frightens us? What values (the things we are for and against) are we interested in preserving as well as promoting by our likes and dislikes of energy/power? Perhaps the question is: What is it that I value about energy/power?

SUM/MARY

Students are asked to decide what they love and hate about power/energy and in groups rank order the choices according to how they should love and hate their choices.

DE/SCRIPT/ION

Ask your class:

1. What are three things that you love about energy/power and three that you hate? Write each of those

that you love and hate on separate sheets of paper or bring in clippings/pictures from newspapers and magazines that illustrate them.

2. Break the class into groups that you are comfortable working with and have students in each group place the responses in two separate groups — a "lovers" and a "haters" pile.

3. Now have the groups arrange the responses according to how they should love and should hate them. They should be arranged from most loved to least loved (or most hated).

4. Share and discuss.

E/VALU/ATION

1. What was the most difficult decision you had to make?
2. In ranking the choices, how were you influenced by the number of times particular items were mentioned by others in your group?
3. What did you learn about energy/power that you did not know before?
4. How would you decide that you are using just about, more than, less than the amount of energy that you should be using?
5. What did you learn about your attitude toward energy/power that you did not know before?

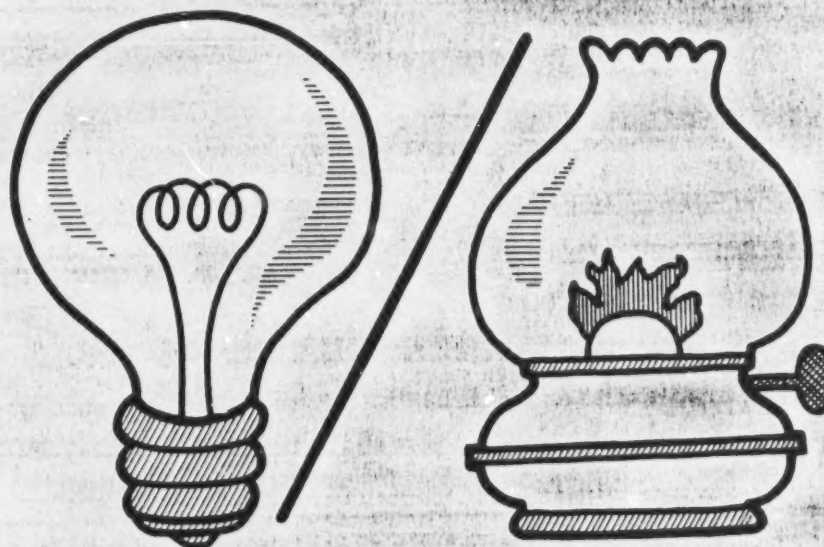
THANKS!

Bill Romey, Geology Department,
St. Lawrence University, first used this
activity with a geology class.

RE/SOURCES

Romey, W. D. 1972. Risk — trust —
love: learning in a humane
environment. Charles E. Merrill
Publishing Company, 1300 Alum
Creek Drive, Columbus, Ohio
43216

ALTER/NATIVE LIVING AS ENERGY CONSERVATION



Today many people are choosing to simplify their lives. One way they can do this is by living an alternative lifestyle. It is hard to group or categorize the range of possible alternative lifestyles, but two general divisions may be helpful. One group, including Mennonites, Hutterites, Amish, Shakers and others, choose to live a simple, machine- and appliance-free life for reasons of religion. A second group, including individuals, families, or groups of individuals and families, choose to live a simple, self-reliant life with little emphasis on material goods.

SUM/MARY

In this activity, students read case histories of people who live alternative lifestyles. Using a checklist of appliances, machines, and gadgets, students will try to decide which of these are used by the people they have read about, and which by themselves and their families. They will compare lists and discuss some of the implications of alternative living as energy conservation. A cross-cultural approach is also suggested.

DE/SCRIPT/ION

1. Provide the class with the two case histories: One, the Bieler, are Amish farmers living in Central Wisconsin and the other, Dave Case,

is a homesteader in a roadless area near the Canadian border in Minnesota.

2. When they have finished reading the stories, fill in the energy-use checklist. There are columns for the Bieler family, for Dave Case, and for you and your family. Column four provides space to check the energy use of a grandparent or an elderly neighbor.

When they have finished filling out the checklist, divide the class into groups of 4 - 6, and have them compare lists and agree on a set of checks. Discuss what the list means:

- How will shortages affect the Bieler? Dave? You? Your family? What changes will each have to make?

- How much time do the Bieler's spend in direct basic maintenance of themselves (food, clothing, shelter)? Dave? You and your family? Your grandparents?
- What are some of the reasons it is more attractive to work long and hard to pay others to maintain us?
- Why do you think greater self-reliance is more attractive to some of us, like Dave and the Bieler's?
- How is it possible that the Bieler's and Dave are able to use so little commercially supplied energy? What is the source of the energy they use?
- What would happen if everyone wished to live like Dave Case? To our energy suppliers? To the economy? To our environment?

3. The checklist and questions can be used as a focus on energy for cross-cultural studies. From descriptions of family life in Mexico, Nigeria, the Baffin Islands, England or wherever, students may be able to make some inferences about energy use in other cultures.

E/VALU/ATION

1. Below are listed things identified as valuable to one or more of the people discussed in this activity. Rank the values below according to their importance to you, placing a 1 in front of the most valuable, a 2 in front of the next most valuable, and so on —

- _____ self-reliance
- _____ travel
- _____ a diet made up of foods from all parts of the country
- _____ TV
- _____ convenience
- _____ hard physical work
- _____ a house evenly warm or cool in all rooms
- _____ a variety of work-saving equipment
- _____ commercial entertainment, such as ball games and movies
- _____ ability to succeed at skills such as house building, food production.

2. Write two energy biographies which describe your energy way-of-life, now and in the future.

DATA SHEET **ALTER/NATIVE LIVING AS ENERGY CONSERV(E)ATION**

Case History #1

Dave Case is in his mid-30's and is homesteading 230 acres in northern Minnesota. He lives alone in a log cabin he built by himself, on the top of a granite boulder overlooking a brown-black, pine-edged lake. His is the only cabin on the lake and he is three miles from the nearest road.

Ten years ago Dave left a job teaching junior high school science in a St. Paul suburb. He had begun to rock climb, he loved white-water canoeing, and he spent increasingly longer periods of time in the wilderness near the Canadian border. The more he developed his ability to live in the wilderness, the more he became convinced that self-reliance was his style.

Dave built his one-room log cabin with its huge stone fireplace himself. All the building materials except the glass and some hardware came from his land. He used wooden pegs in construction rather than nails. He put a layer of sod, from six to ten inches thick, on his roof as insulation. He calculates that it makes the temperature 20 percent warmer in the winter and 20 percent cooler in the summer. As an added bonus, wild raspberries have seeded themselves in the sod, and produce a crop of fruit each summer.

Dave's bathroom and laundry is his sauna. He does his laundry by hand while he saunas. The log structure sits above the lake, which he uses both winter and summer to cool off at the end of his bath — in the winter he cuts a hole in the ice!

He has no running water and uses the lake water or rain barrel water for his household needs.

Dave heats his cabin with wood, but he cooks with propane; he uses about \$13 worth a year. Kerosene supplies his light which costs him about \$5 a year. Part of the reason he uses so little of each is that he moves out of his cabin every summer into a tent where he cooks outdoors over an open fire. "A person has to have a change; has to get away. I spend a lot of time in that cabin in the winter," Dave says.

Dave intends never to build a road. In the winter he brings in supplies with his dog sled and moves about with snowshoes and cross-country skis; in the summer he uses a canoe to bring in supplies.

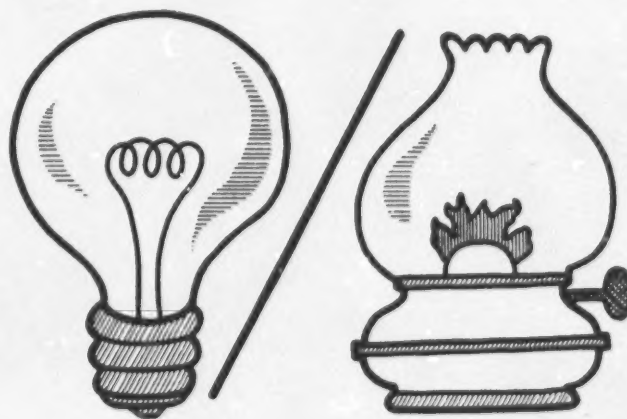
He grows 70 percent of his food, a diet which consists of wild fruits, fish, and garden vegetables. He goes no further than his roof for some of his raspberries, fishing luck is never bad in his lake, and his richly-composted, terraced garden produces magnificent vegetables. Dave has not

experienced any insect infestations in his garden. He speculates that the next nearest garden is so far away that it is not worth the bug's time to travel between them.

His vegetables and fruits are preserved in a variety of ways. He has built a root-cellar into a hillside, where the year-round temperature remains around 7°C (44°F). He cuts ice blocks from the lake in the winter, places them in a hole in the ground and has a "refrigerator" until late June. His dairy products are kept in two barrels buried in the ground; he has a large, natural crack in a rock nearby which goes down about 8 meters (25 feet) and keeps water frozen in its bottom until the end of July.

Dave needs no trash collector because he produces no waste. He buys nothing in cans or jars and any leftovers become garden compost or sled-dog food.

Dave lives on \$500 a year, \$350 of which goes to property tax and insurance! He intends never to have a telephone or electricity. "One thing I am afraid of is adding convenience to my life," he says.



DATA SHEET

ALTER/NATIVE LIVING AS ENERGY CONSERV(E)ATION

Case History #2

Ira and Barbara Bieler and their nine children farm in Central Wisconsin. They are Amish, as are 75 percent of their neighbors. The valley they live in has no utility poles. The Bielers, like other Amish, have no telephone or electricity.

Barbara Bieler's kitchen is the center of the family's indoor activity. Here she cooks meals for a family that has done strenuous physical work all day. She cans, pickles, preserves, and dries food. In this room, over the dining table, hangs the only lamp in the house — a pressure lamp much like an ornate version of our familiar gas camping lantern. Hand lamps or candles are available for taking to other rooms when necessary, but most family activity is done in the kitchen, and bedtime is early. This room also contains the black, cast-iron, woodburning stove that heats the whole lower floor. Bedrooms have grates in their floors to allow heat to rise from the stove below. In the corner of the room is a treadle sewing machine at which Barbara and her older daughters make all the family clothes. In years past, cotton and woolen fabric was made by hand and stitched into pants, shirts and dresses by hand.

The Amish were recycling long before the word was coined. Ira says, "Nothing is wasted here." Harnesses are patched for generations; left-over food becomes garden compost or animal food; what few cans the family uses become containers for plants.

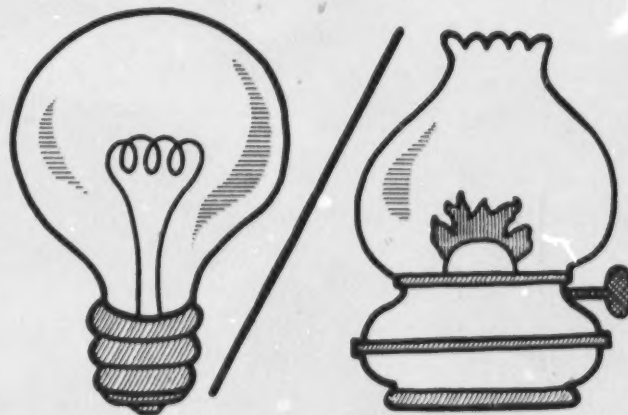
Barbara uses a hole in the backyard as a "refrigerator". It is covered with a heavy, wooden door and it keeps butter, milk, cheese (all produced on the farm) at a uniform temperature year round. Another dirt mound with a wooden door at its entrance is a root cellar where Barbara and her daughters store root vegetables, apples, and squash, all grown in a huge garden. She cans meat, poultry, fruits and vegetables — enough to meet the entire year's needs. There is no plumbing indoors, but there is a hand pump at the kitchen sink. Another pump sits in the yard.

Ira does all his farm work with teams of horses. He raises dairy cows, a few beef cattle, hogs and chickens. The chickens are penned separately — the eaters and the layers.

Ira's traveling is done in a boxy, closed, black buggy, hitched behind a single horse. The Bielers do not go far, and they do not go fast.

To Help You Discuss The Checklist

1. How will energy shortages affect the Bieler's? Dave? You? Your family? What changes will each have to make?
2. How much time do the Bieler's spend in direct basic maintenance of themselves (food, clothing, shelter)? Dave? You and your family? Your grandparents?
3. What are some of the reasons it is more attractive to most of us to work long and hard to pay others to maintain us?
4. Why do you think greater self-reliance is more attractive to some of us, like Dave and the Bieler's?
5. How is it possible that the Bieler's and Dave are able to use so little commercially supplied energy? What is the source of the energy they use?
6. What could happen if everyone wished to live like Dave Case? To our energy suppliers? To the economy? To our environment?



DATA SHEET **ALTER/NATIVE LIVING AS ENERGY CONSERVATION**

ENERGY-USE CHECKLIST COMMON ENERGY-USING EQUIPMENT	Bielers	Dave Case	You and Your Family	A Grand- parent or Other Older Person
Dehumidifier				
Power-Driven Water Pump				
Attic Fan				
Sump Pump				
Snowmobile				
Lawn, Garden or Farm Tractor				
Engine Heater				
Motor Boat				
Automobile				
Humidifier				
Window Fan				
Air Conditioner				
Portable Heater				
Stereo				
Mini Bike				
All Terrain Vehicle				
Record Player				
Electric Blanket				
Vaporizer				
Ice Cube Maker				
Refrigerator				
Electric or Gas Oven				
Electric or Gas Cooktop				
Iron				
Radio				
Snow Blower				
Roto-Tiller				
Chain Saw				
Electric Clock				
Table Fan				
Vacuum				
Wood Lathe				

ENERGY-USE CHECKLIST **COMMON ENERGY-USING** **EQUIPMENT**

Bielers

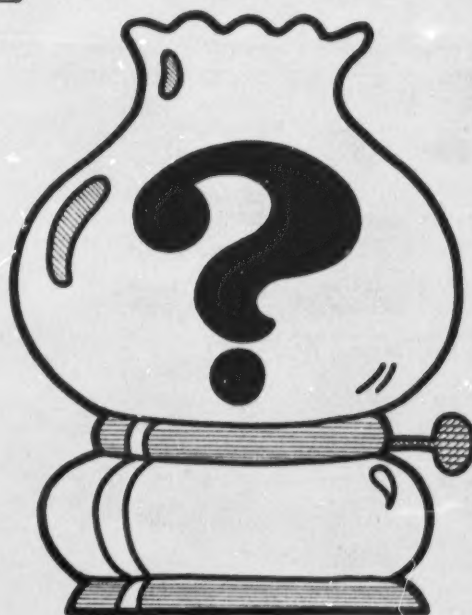
Dave
Case

You and
Your
Family

A Grand-
parent or
Other
Older
Person

Grinder
Trash Compactor
Garbage Disposal
Hair Dryer
Dishwasher
Electric Floor Polisher
Sewing Machine (Electric)
Garage Door Opener
Blender
Mixer
Electric Shaver
Electric Knife
Electric Can Opener
Heating Pad
Slide Projector
Electric Games & Toys
Electric Vibrator
Electric Toothbrush
Electric Typewriter
Electric Calculator
Electric Tape Recorder
Black and White TV
Color TV
Electric Lawn Edger
Electric Hand Drill
Electric Hand Saw
Washing Machine
Dryer
Electric Coffee Maker
Electric Toaster
Hot-Curler Set
Electric Yard Light
Gas Post Light
Electric Freezer

THE GOOD AULD DAYS(?)



Were the "good old days" really that good? Talking with someone who grew up in a much less energy intensive period or finding tools or written descriptions from that period may give your students a deeper understanding of the changes that have taken place in energy use than reading about them in a history book. But such secondary resources may also be useful. By reading descriptions of frontier life, or life in a new city, students may be able to make some assumptions about the use of energy.

As a Bicentennial project, the Energy Research and Development Administration has printed a poster, "Energy History of the United States: 1776 - 1976." You may find it helpful. (See Resources)

SUMMARY

Students compare the differences energy has made in lifestyles over the past 75 years and are encouraged to find out to what extent increased energy use has led to a more enjoyable lifestyle. The activity emphasizes the use of primary sources to find out this information. Four separate approaches (which could be combined) are suggested.

DE/SCRIPT/ION

Find out about people and energy use — 50 to 100 years ago. Ask questions such as:

- what kinds of energy did they use?
- where did it come from?
- how did they use it?

1. Interview people born before 1920. Ask them questions about how their families used energy. What energy consuming appliances did they use/own? Find out how they felt as "more modern" means of obtaining energy were introduced into their lives. What energy event affected their personal lives the most? Was life easier as they used more energy consuming appliances? Were they happier with more energy conveniences? Your students may find it easier to brainstorm a list of questions they want to ask before they conduct their interviews.

If you can, tape the interviews, or if you have the facilities, video tape them. Compare their families' energy use with present day family use. Students could write this up as a feature story for a newspaper.

2. People use energy in many different ways:

- to build and fix things
- to cook and clean
- to have fun

Do families today use more or less energy (and what forms of energy) than a family in 1900 did? Show how uses have changed. Have students bring in a tool kit from 1900. From today. Do the same with kitchen utensils and/or a cleaning kit. With athletic equipment and supplies. Encourage the use of family members, grandparents and older people in the community. If students cannot find something, have them draw a picture of it, or if it is too big to bring in, have them photograph it or find some other way to share it.

3. Have students use primary sources as clues to find out how people used energy long ago. Interviews, artifacts, old newspapers, magazines, diaries, and photographs are all primary sources. Reprints of old newspapers, popular magazines and catalog replicas (see Re/sources) are readily available in many libraries and bookstores. You could have students make a collection of pictures which contrast the past and the present: modern kitchens and old-fashioned kitchens; modern schools and old schools; modern construction and old construction techniques.

4. Another approach to this activity is to present the activity (e.g., How was energy use different in 1920 than it is today?) to students as a problem they have to solve. Have them brainstorm different solutions, use their solution, and compare the results.

E/VALU/ATION

1. What is the most important energy-consuming invention in the past 75 years? In your life? In your parents' life? In your grandparents life? For society? How do you decide?
2. Pick five energy-consuming inventions of the past 75 years. Which would be easiest for you to live without? Hardest? What are some of your reasons?
3. Write or tell a story about yourself as if your family could only use wood and coal for fuel. Make your life sound as pleasant and enjoyable as possible. How would you like to live that way? How would your life change?

RE/SOURCES

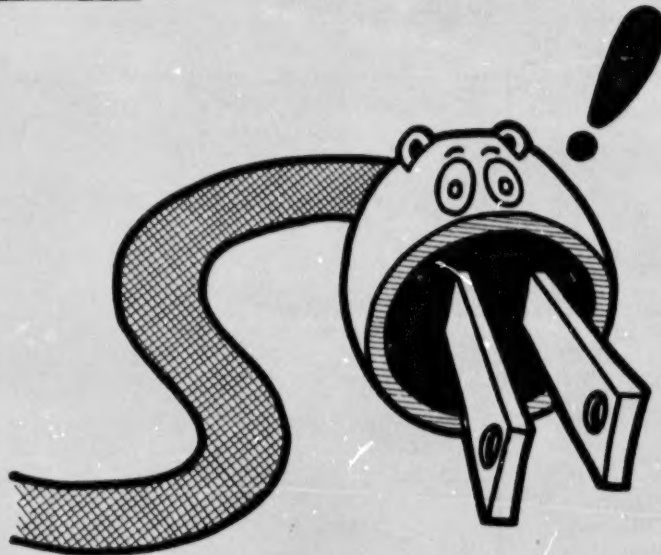
Bettmann, O. L. 1974. The good old days — they were terrible! Random House, New York (\$4.95)

1976 Energy history of the United States: 1776 - 1976. Energy Research and Development Administration, Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830 (free, request on school stationary)

Schroeder, J. (Ed.) 1970. Sears, Roebuck and Company Catalogue: Nineteen Hundred Eight. Digest Books, Northfield, Illinois (\$3.95) Schroeder has also edited the following catalogue replicas: 1894 Montgomery Wards; 1896 Marshall Field and Company; 1900 Sears Roebuck and Company.

Wigginton, E. (Ed.) 1972. The foxfire book (\$4.50); 1973 Foxfire 2 (\$4.50) and 1975 Foxfire 3 (\$4.95) Anchor, New York.

IMPLICATIONS



Alvin Toffler in his book, **Future Shock**, popularized and shared with a very large audience some of the effects of change and ways of adapting to the future. Interest in the future fits naturally with environmental, energy and social concerns. We have, for example, become increasingly concerned with both the short and long term effects of our interventions in the environment.

The energy situation, which is intimately related to our environmental concerns, has also shown us that energy is a potent economic and social force. Some of the effects of the energy crisis, such as inflation and unemployment, hint of some different lifestyles than those to which we are accustomed. We want to know not only about the availability of options to us but also what the implications of various alternatives mean to us personally and as a society.

SUM/MARY

The implications wheel or futures wheel is a tool which can help students examine possibilities and implications of trends and innovations. It helps students understand the complexity and ramifications of trends and innovations. It emphasizes interrelationships and provides a graphic and manageable way of examining complexity.

DE/SCRIPT/ION

Some materials needed: Magic markers

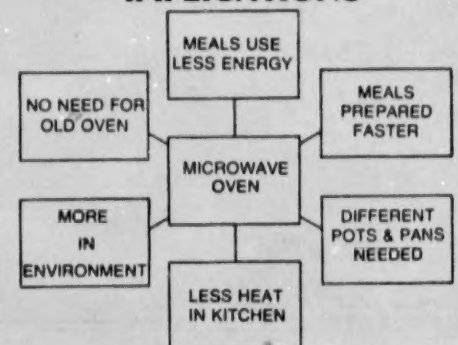
Newsprint or butcher paper

Introduce this activity by placing an energy innovation or energy trend (a gasoline tax increase of 25¢ per gallon, farmers refuse the construction of large power lines, solar heating costs same as electric heating, etc.) somewhere near the center of a piece of paper. Draw a circle around it. Then ask the class this question, "What are the effects of this innovation or trend?" Write each

of the effects outside and around the circled energy innovation or trend and draw circles around each of them. Draw lines connecting the outside circles with the central circle. An example for a microwave oven is found in Figure 1. The initial reactions and impressions are called first order implications. This is indicated by the single lines connecting the energy innovation with the effects of the innovation.

Figure 1. First order implications. (from Barker, 1975)

A FUTURES WHEEL WITH FIRST ORDER IMPLICATIONS



Now ask the same question — “What are the effects of this innovation or trend?” — for **each** of the first order implications and connect the new implications with two lines.

Continue this process for about four orders of implications. Third order implications are connected by three lines; fourth order implications by four lines and so forth. Future wheels can get out of control. There are visual, spatial and conceptual limits.

Remember that the judgments that learners make are not right or wrong or even necessarily highly probable. They represent possibilities and should be treated as such.

A futures wheel developed for the microwave oven with six orders of implications is found in Figure 2. The number of connecting lines indicates the order of the effect.

Now that you have helped students understand what they are to do, ask each student to make an implications wheel for an energy trend or innovation. Hang the wheels on the walls and have students share them with the class.

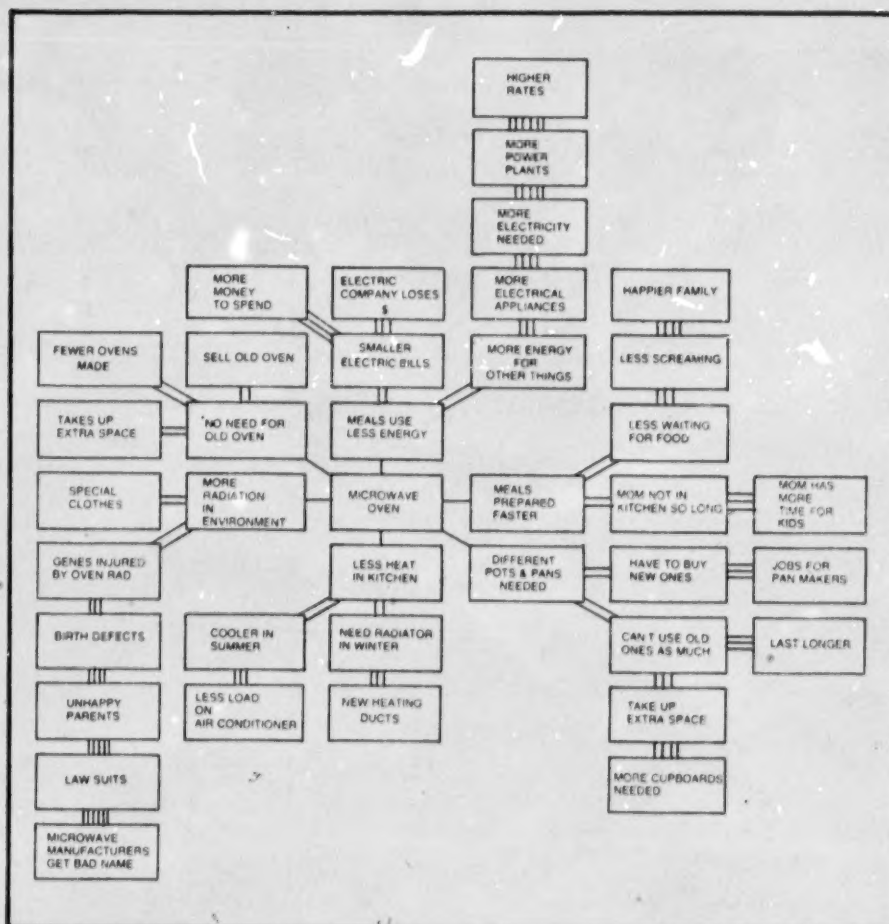


Figure 2.

An implications futures wheel showing multiple implications. (from Barker, 1975)

E/VALU/ATION

1. Decide whether each effect is good (G) or bad (B).
2. Assign probabilities to each effect on a scale of 1-5 with 1 being almost sure that it will happen and 5 being almost sure that it will not happen.
3. Is your trend something you would like to see happen? Why or why not?
4. Which implication would you like to know more about?

THANKS!

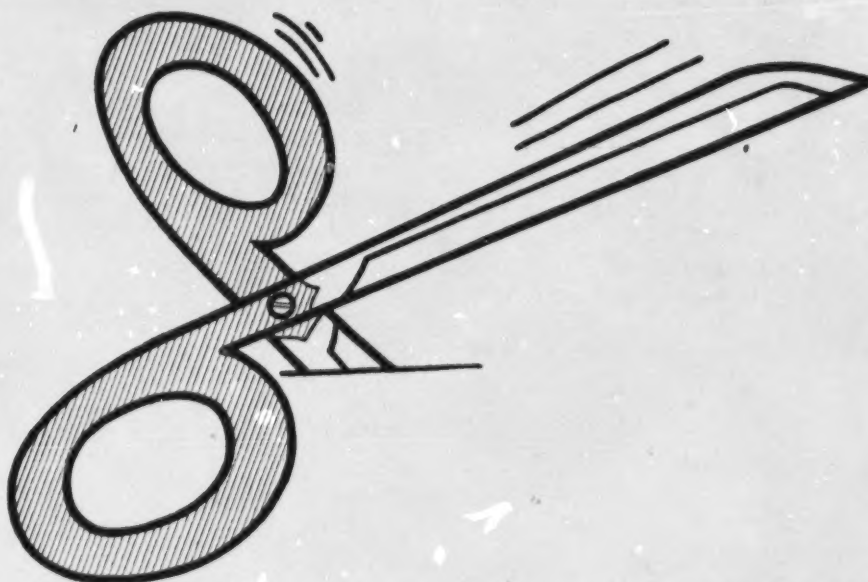
Joel Barker, Director, Future Studies Department, Science Museum of Minnesota, St. Paul, Minnesota 55101, for permission to use Figures 1 and 2.

RE/SOURCES

Barker, J. A. 1975. Futures Study in Curriculum Planning. pp. 56-61 in T. L. Holthusen (Ed.) The role of future studies in public education. Misc. Publ. of the Science Museum of Minnesota. Number 4. St. Paul, Minnesota 55101.

Toffler, A. 1970. Future Shock. Bantam Books, New York.

THE CLIP/PER TRIP



Our worsening energy situation has occurred gradually, not instantaneously, although it may appear that way. One way to monitor the extent and meaning of the energy dilemma is by collecting information from a wide variety of newspapers and magazines.

A clipping file can provide a basic classroom energy resource. One of the problems with such a resource collection is how to file it as well as how to summarize its contents. One way is to look for signals and clues in the materials and then give them some labels. As a file is developed over a period of time, patterns can be detected and trends can be extrapolated. A person can then keep up with emerging events and developments. The significance as well as the implications of a series of events can also be explored.

The consequences of many human activities have not attracted much general interest or concern until recently. Today more and more questions are raised about the effects of highways, construction, and waste disposal on both people and the natural environment. We are beginning to say that if we do

such-and-such then there are likely to be certain effects. Of course, not all the suspected effects are equally likely but we are beginning to recognize that whatever we do has a number of possible consequences.

Many of our social and environmental problems are rooted both in our fascination with talking about the past and also because we have little experience in learning how to anticipate the possible effects of our actions. Role-playing the possible consequences of an action may help us to think more about our impact upon the environment.

Once we collect some information and have time to wonder and speculate about it we may be interested in learning how other people think and feel about the issues. This kind of information can be collected through the use of attitude surveys or questionnaires.

There are many differences between an interview and a questionnaire. In a questionnaire a set of questions is prepared and a large number of people respond to them, usually in ways — yes, no, checklists — that helps simplify the analysis and interpretation of the responses.

Interviews are often rich experiences because they allow an interplay between two or more people. They provide opportunities to pursue leads and to investigate angles. People respond to each other as individuals. These opportunities are much less available when you acquire information through the use of questionnaires. However, questionnaires also have their strong points. One of them is that you can sample and make visible a wide range of opinion. Some major differences between questionnaires and interviews are breadth vs. depth and generality vs. particularness.

SUM/MARY

Students collect information from newspapers and magazines about the energy situation. The topics can be broad (energy) or narrow (solar, wind, peat, conservation). The information collected is monitored and evaluated for possible effects and implications. A suggested monitoring format is included. Students play an energy game which makes use of the information collected and monitored. In this game, one group, **the people**,

define an energy problem and another group, **the environment**, respond with a solution. The two groups, people and environment then respond, in turn, with the consequences of the suggestion. The game can be played throughout any unit on energy to help summarize energy relationships and to encourage divergent thinking. Finally, students develop an energy questionnaire which can be used to sample opinions from students and community members on energy issues.

DE/SCRIPT/ION

Part 1: A monitoring journal can be kept by a class, small groups or by individuals. The topic monitored can be as large as energy or a part of the energy dilemma. The latter is probably a much more reasonable and manageable approach. Some topics include: conservation, oil, atomic energy, natural gas, gasoline, technology, coal, or alternative sources of energy. Different groups/individuals could take responsibility for each of these as well as other categories that you and the class decide upon.

As clippings from magazines and newspapers are collected over a period of several weeks have students make entries in a monitoring journal. A suggested format is attached. Students may find it helpful to underline key ideas in the articles. Do not extend this activity for too long unless your students are interested.

Part 2: Now that you and the class have collected some information, it can be used in a simple energy "game". Divide the class into two teams. One of the teams is the "people"; the other group is the "environment". Toss a coin to determine which group speaks first.

The first group defines an energy dilemma.

The second group responds with a solution.

The first group responds with a consequence of the solution.

Etc.

If individual students tend to dominate, impose limits that you are comfortable with. Encourage a cooperative and participatory effort by the players. You should decide on the length of the session. An example of the beginning of a game sequence follows:

Environment: I am running short of crude oil.

People: We will use more coal.

Environment: Mining is hazardous to my health. It changes my streams, pollutes my air, and limits the number and variety of animals and plants which live in my house.

People: We will restore the land after we use it.

Environment: You will still have changed ways in which water flows over and through me. Tell me how you will do it so that it is the same as before.

Some teachers who tried this activity suggested using individual students to represent the "people" and the "environment" or dividing the class into small groups of 4 to 6. A moderator, who will also act as the recorder, is needed for each group.

It is useful to summarize the responses on the chalkboard or on butcher paper as suggested below.

Energy Dilemma: _____

Persons

Environment

22

Some things that can be done at the end of a round:

1. Have each student write their response to the next answer. All of these can be added to the list or you can ask students to share their responses with the class.

2. Review each of the claims with the class. Ask students to assign probabilities on the likelihood of the event happening: (1) quite sure; (2) maybe; (3) could happen; and (4) will not happen.

3. Have the class decide how bad or good the effect would be: (a) very good; (b) good; (c) does not make much difference; and (d) very bad.

The game can be played for several days. In between sessions participants can seek additional information from newspapers and magazines, about the responses. These can be shared with the class and added to the list.

Part 3. Perhaps the articles that students have read, summarized and used in talking about people-energy issues may make them wonder what others think about the energy situation. If this is true, students can check-out a wide range of opinion through the use of a questionnaire. In addition, responses to questions can be compared, e.g. among age and occupational groups.

There are many things to consider when a group decides to do a questionnaire: What is the purpose? Who will receive the questionnaire? How will the information be collected? How many questions? What kinds of questions? How will the results be interpreted?

Each one of these questions can be answered in a variety of ways. This is the main reason that the directions which follow are not specific but instead raise some questions about constructing a questionnaire.

The development of a questionnaire and struggling with the issues mentioned above are important learning experiences. Another value of a questionnaire is that it can help students focus on local energy concerns and problems. This offers students an opportunity to learn about using an important learning resource: their local community. Help your students with the questionnaire by asking them some of the following questions:

- a. How many people do you want to respond to the questionnaire?
- b. Is your sample going to include students, teachers, community people, a range of ages? Do you want to identify persons who respond? How? Ages, occupations, male, female?
- c. How are you going to select your sample? Can you be sure that you are not selecting a group of people with only one point-of-view? How?
- d. How are you going to collect information? Will you use:
 - a questionnaire that you read to people and on which you record their responses
 - a questionnaire on which people respond
 - a telephone survey
 - a mail survey
 - a door-to-door survey, or
 - something else and,
 - who is going to collect the information?
 - by when?
- e. What about the questions?
 - how many; when is a survey too long?

- what topics are represented? Some possibilities include: transportation, energy independence, home electricity use, energy conservation, agricultural energy use, attitudes, beliefs values, nuclear power, etc.
- are the questions clear or do they contain two questions?
- should the questions be grouped by topic?
- who is going to write them?
- what type of responses do you want? true/false, agree/disagree, checklists, open-ended items, for example:
 1. Do you believe there is an energy crisis? You could have respondents circle: (yes), (no), (no opinion), or check one:
 - agree strongly
 - agree somewhat
 - don't know
 - disagree somewhat
 - disagree strongly
 2. Energy can be neither created nor destroyed.
(circle one) true/false
 3. Rank these from those you consider most important (1) to those you think least important (4). If energy use were rationed in our school, we should eliminate
 - night athletic programs
 - all Saturday programs
 - after school activities
 - air conditioning
 4. Rank order these from most important (1) to least important (6). The energy crunch was caused by: — the Arabs

- environmentalists
- we, the people
- government
- oil companies
- clean air and water requirements

5. What bothers you most about the energy situation? _____

- f. Now that the responses are in, what are the students going to do with them? First, tally the responses; then, look for patterns in the responses. In check-lists, are some items checked more often than others? Are there differences in the way high school students and community people responded? Would another group agree with the responses? Consider trying the survey with another group.

Are you going to write a report and try to have it published in the school newspaper or summarize your information so that it can be used in a radio program or make a display for your school or participate in a public meeting on energy for the local community group?

- g. Consider developing your questionnaire in cooperation with a community group. The League of Women Voters may be a good place to start. Perhaps your school administration would be interested in a school energy opinionnaire. These are only two of many groups interested in energy who could learn from you and from whom you could learn.

E/VALU/ATION

1. If you were going to write the next article for entry in the monitoring journal, what would you like it to be?
2. Pick three entries (every third item or some such scheme) and note the source of the information. What values (things that people are for and against) do you think this source might have? How would you check these values?
3. What are facts in the articles and what are opinions? How do you decide? Rate on a scale of 1-5 (one = completely trust; five = absolutely do not trust) how much you trust an article. What influenced your decision?
4. One thing that was important to me that I learned from keeping a monitoring journal was
5. When you read or hear about something, do you like to know as many conflicting opinions and learn as much information as you can? If yes, what does that do for you? If no, what are some things you might be missing?
6. If you could make one change in the way you, your home/ community/state/country used energy, what would you change? What would the consequences be?
7. Do you feel optimistic or pessimistic about the energy future of Minnesota? United States? World? What are some of your reasons?
8. What did you learn about the group you sampled that you did not know before you did the questionnaire?
9. What are some of the advantages and disadvantages of your questionnaire?

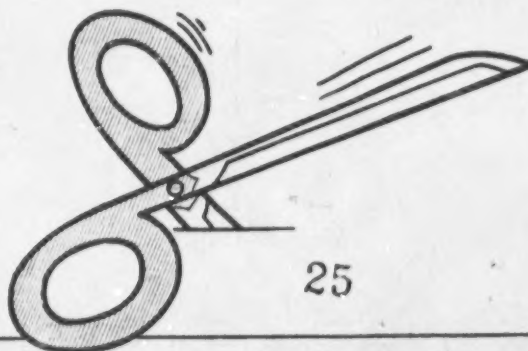
RE/SOURCES

Wigginton, E., 1975. Moments. IDEAS, 1785 Massachusetts Avenue NW, Washington, D.C. 20036 (\$3.95)

DATA SHEET CLIP JOINT

MONITORING JOURNAL — A SUGGESTED FORMAT

No. Initials	Brief Description of Energy Event	Other Effects — Environment, Economic, Social, Legal	Possible Significance	Comments
1 Motown News 7/14/76 EH	Tighter sealing fuel tank caps will reduce the number of gallons of gasoline wasted by evaporation.	Environment—less smog formed. Economics—will add an average of about \$8 to the cost of a new car. Legal—required in 1978 car models.	This should increase average miles per gallon.	I wonder how much gas has been wasted by evaporation? Is it a lot?
2 Down Under Magazine 7/30/76 SH	Underground or earth-covered buildings can result in an energy savings of at least 75%	Environment—less energy required.	Many new buildings may (should?) go underground because of the energy conservation.	I am not sure I would enjoy living underground unless there was at least one skylight.
3 Mind and Environment 8/1/76 JB	Dr. Marjorie Peterson says that people will accept living and working in underground buildings as well as in above ground buildings.	Social and environment—energy can be conserved and people can still enjoy using energy saving buildings.	It should be easier to convince home builders and industry to consider the advantages of living underground.	I thought that most people would not enjoy living underground. I had never thought of this but there are many department stores, libraries, museums, and theatres above ground, with no windows.



FOR PEAT'S SAKE



Peat is an accumulation of dead plants in varying stages of decomposition. Peat formation occurs in areas where water saturates plant materials for long periods of time. The water has the effect of slowing down the rate of decay because of the absence of oxygen.

Plant material is largely cellulose, a large molecule, composed of carbon, hydrogen, oxygen. As the dead plants are subjected to increasing pressure, the cellulose molecules break down with the loss of hydrogen and oxygen. The remaining material, peat, is rich in carbon and may be thought of as geologically "young coal".

The Minnesota peats range in age from roughly one hundred to ten thousand years old. The depth of peat deposits range from 1.8 meters to more than 6 meters (6-20 plus feet). Their distribution in Minnesota is widespread (Figure 1.) although the major and concentrated peat deposits are found in northern Minnesota (Figure 2.)

Minnesota has more than seven million acres of peatland. The peatlands account for approximately 50 percent of the peat present in the continental United States. Peat is Minnesota's only fossil fuel resource. It is used as a fuel to produce electric power in countries such as Ireland, Finland, and Russia. All of these countries have plans to increase their

peat production. There is little known about what impact this may have on the natural environment. In this country, peat is used as a soil conditioner, and for the production of crops such as vegetables, cranberries, timber, Christmas trees, and blue grass turf for lawns.

There is considerable interest in using peat as an energy resource in Minnesota. This is because of our dependence on energy imports and the likelihood of future energy shortages. Petroleum products, from which we obtain 46 percent of our energy, are obtained mainly from Canada. Canada has promised a crude oil cutoff in the 1980's. Most of

our natural gas is imported from the southwestern United States. Natural gas currently supplies approximately 32 percent of our present energy needs and demands. These natural gas supplies are expected to decline about 2-3 percent per year during each of the next ten years.

Peat has about the same heating value as lignite, a low quality form of coal. The low sulfur content of peat is similar to western coal. If Minnesota's peat resources were harvested, oven-dried, and burned there would be enough to supply **all** of Minnesota's energy needs for 50 years at the present rate of energy consumption.



Figure 1. Peat resources of Minnesota: general distribution. (Department of Natural Resources, November 1975)



Figure 2. Major peat deposits of Minnesota. (Minnesota Energy Agency, January 1976)

There are plans to develop Minnesota's peatlands as a source of fuel, but peat would not be burned directly. What is being explored, instead, is whether it is feasible to develop a peat gasification facility which would convert peat into synthetic natural gas (syngas). One large gas company (Minnegasco) has applied for a 25 year lease on approximately 80,000 hectares (200,000 acres) of state owned peatlands in Beltrami, Koochiching, and Lake-of-the-Woods counties. At full commercial capacity, the gasification facility would be capable of producing 25 percent of the natural gas used in Minnesota in 1974 approximately 7,080,000 cubic meters (250 million cubic feet) per day.

SUM/MARY

Our future energy supplies will depend increasingly upon alternative energy resources. One of the primary alternative energy resources being considered for use in Minnesota is peat. This activity offers an opportunity for science and social studies teachers to cooperate. There are experiments/demonstrations on the heat value of peat as compared to other materials and the conversion of peat to gas. Participants are also supplied with some background information on the economic, social and environmental impacts of harvesting and using peat for energy production. After assessing this information, they write a statement to be presented at a hearing which begins with, "I urge you . . .", and then share this response with others.

DE/SCRIPT/ION

1. Get some peat.

From a garden store or a peat bog. Be gentle if you take your class into a bog — they are delicate, fragile, and are especially vulnerable to human intrusion. Try not to leave a beaten path. If you collect peat from a bog obtain samples in various stages of development. This would include a

range of samples collected from the top of the bog to well below the surface. The samples will have to be dry before you can use them. Compare the weight of the samples when wet and when dry.

2. Peat heat

What you need:

- a. test tubes — pyrex
- b. test tube holders
- c. test tube racks
- d. thermometer
- e. needles in corks, teasing needles
- f. graduate cylinders
- g. tile plates
- h. a balance or scale sensitive to 0.1 grams

- i. peanuts, walnuts, brazil nuts
- j. dried peat
- k. wood pieces
- l. matches
- m. tripod stand
- n. tin cans: coffee, food
- o. can lids
- p. tools: hammers, screwdrivers, needle-nosed pliers, tin snips, large nails

What you do:

Because so much heat is lost to the surroundings in this experiment, you may want to construct "chimneys" to insure better results. A way to do this is illustrated in Figure 3. This simple apparatus is used to measure calories and is known as a "calorimeter."

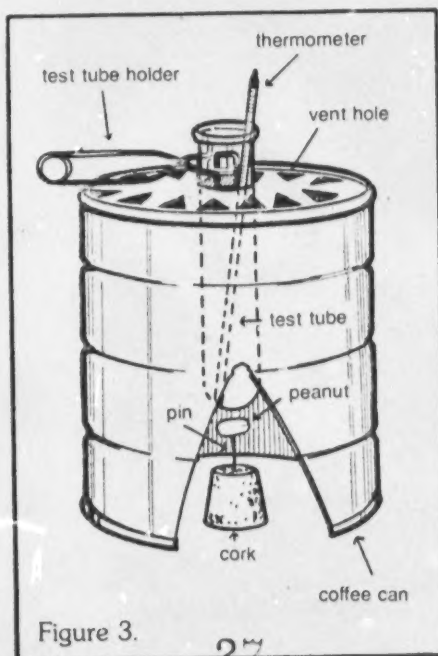


Figure 3.

a.) Pour 10 ml of water into a test tube. Take the water temperature. Be sure you take the thermometer out of the water after you take the temperature.

b.) Shell a peanut and weigh it. It should weigh between 0.20 to 0.30 grams. Small samples are necessary because large sizes may cause the water to boil. If the water boils before the sample completely burns it is impossible to know the amount of heat transferred.

c.) The shelled **peanut** should be placed firmly on the needle. Make sure that the needle is held securely in the cork. Place the cork on a tile plate unless you are working on a non-combustible laboratory surface.

d.) Use a match to start the peanut burning. Put the burning peanut under the test tube as quickly as you can. Do not get your face over the top of the test tube and do not point the test tube at anyone. Be sure that the peanut burns completely. When the flame goes out, take the temperature. Remove the thermometer. Calculate the gain in temperature. Do this experiment two or three times and compare the results.

e.) Now do this for peat and wood. Do not use pieces which weigh more than the peanut you tested. Hold the peat on a wire screen and tripod or in a tin can lid, so that you can burn it. Do this two or three times for each material used and record your information in a table which includes the name of the material burned, its weight (mass), the water volume, the beginning temperature and the ending temperature.

f.) If you want to get fancy, subtract the beginning water temperature from the ending water temperature (in C°) and multiply this number by the volume of water (in mls) to obtain the amount of heat energy (gram-calories) absorbed by the water. There are 1000 gram-calories in one food calorie. The food calorie is always

capitalized (C): gram-calories are designated by a small c.

3. Suggested plans for the use of Minnesota's peat resources are on as a gas rather than as a solid fuel. You can demonstrate or have your students demonstrate the production of gas from peat. If you elect to do this experiment, do not use your best test tubes! A student worksheet is included.

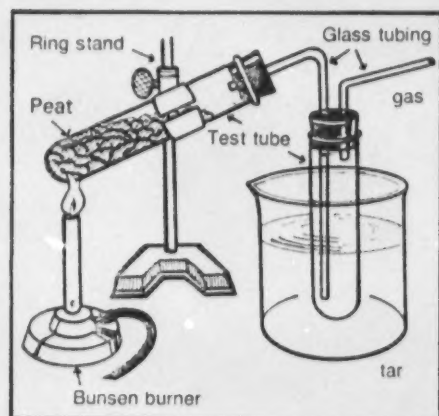


Figure 4. Destructive distillation of peat.

What you need:

- a. test tubes — pyrex (approximately 15 cm x 2 cm)
- b. glass tubing
- c. rubber stoppers, one-hole and two-hole, #3
- d. bunsen burners or alcohol burners
- e. glycerin, silicone grease

What you do:

Fill a test-tube about half full of dry peat, and connect it as shown in Figure 4. The amount of peat will vary depending on its source (bog or store). Be prepared to "experiment" with the amount.

b. If you have students do this experiment it is strongly recommended that you make all the connections between the glass tubing and the rubber stoppers before class. It is very easy to break glass tubing as it is pushed through stoppers. Once you have this apparatus together it can be stored and used year after

year. When you push glass tubing through rubber test-tube stoppers be sure that the tubing is well lubricated. Glycerin, silicone laboratory grease, and water are often used as lubricants. Hold the glass tubing close to the stopper while it is being pushed to reduce the chance of the glass breaking in your hand. Be careful!

c. After you have the apparatus together heat the test-tube strongly for 5 to 10 minutes with a bunsen flame. It is a good idea to do this under a laboratory hood or in a well-ventilated room. Alcohol burners can be used for the heat source but two burners are required for each distilling tube. If this is the only heat source available to you, a description of an apparatus which can be used to distill peat is found in Figure 1.1 of the second edition of *Introductory Physical Science* (Haber-Schaim et. al. 1972, pp. 3-4).

d. Ask students to watch carefully and record what happens. Try to ignite gas coming from the condensing tube. (It may tend to burn sporadically.) When you are finished remove the material left in the distilling tube and have the students try to decide what it is. Have them describe it as carefully as they can. What evidence is there that gases, liquids and solids were produced? You might want to ask some general questions about the purpose of parts of the apparatus, e.g., what is the purpose of the condensing tube; etc.?

4. Students play the role of citizens of Peatsville, Minnesota (or the community where they live). As members of a community which would be affected by harvesting peat for energy production, they want to influence this important decision. Each of them intends to voice an opinion at a public hearing in their community.

If your class did the energy activity titled "The Clip/per Trip," they may already have information on peat which can be used to help them in making a decision on whether peat should or should not be used for energy production. A collection of statements related to the peat energy

issue is listed below. The list is not exhaustive. You might want your class to read a general article on peat (see Re/sources) for additional background information and to add to or further clarify some of the items listed.

In reviewing the list have students mark each statement with a plus (+) or minus (-) to indicate whether the item listed is a positive or negative influence or producing power from peat. If a statement seems neither positive nor negative, ask students to mark it with an "n" (neither). Ask students to make a decision about the major area influenced by the statement by marking it with "en" for environment, "ec" for economic and "s" for social.

When they are through, have students tally their responses, and use this information to write a statement that they plan to make at a community hearing on the use of peat as an energy source which begins: "I urge you to. . ."

One way to share the individual responses is to set up a hearing panel to listen to the responses. The panel could represent a state agency, local legislators, or representatives of local government. This panel could consist entirely of students from the class or consist, in part, of people outside the class who are "neutral" to the activity. The panel should also be prepared to make a decision based on the "evidence". They will need to decide on some rules for doing this. The hearing panel should be encouraged to ask questions of the community people.

If you decide to do this, divide the class into small groups and ask each group to write a group statement which accurately represents their point of view and or which each of them can agree. Try to capture the spirit of a hearing — tape recorders, microphones, video equipment, long table for the panel, names for groups (Peat Power Now, Friends of the Bogs, etc.) — urge all to play their parts.

THE STATEMENTS

- Canada will cut off oil and natural gas supplies to Minnesota in the 1980's.
- There will be a steady reduction in natural gas supplies to Minnesota from the southwest United States during the next ten years.
- The major peat harvesting areas are in northern Minnesota. They are flat, swampy and filled with mosquitos.
- Peat, when it is burned, contributes very little to air pollution.
- Minnesota has no major fossil fuel energy resources such as coal, oil or natural gas of its own.
- Synthetic natural gas produced from peat could be used in taconite mining.
- Synthetic natural gas produced from peat could be used in the food processing industry.
- Peat harvesting could lower the surface of the land 10 to 20 feet.
- Peat harvesting could lead to a reduction of water quality and flooding in northern Minnesota.
- Peat harvesting might affect fish and wildlife.
- Most of Minnesota's peat is on state-owned land.
- A large peat harvesting operation could employ 3,000-4,000 workers for harvesting, handling and processing.
- Peat harvesting is only practical in the summer.
- A synthetic natural gas producing peat industry might employ 1,000 workers year around.
- A synthetic natural gas producing peat plant would require huge areas to supply and fuel a power plant (100,000 acres).
- The supply of synthetic natural gas from 200,000 acres would last for 20 years.
- There are more than 7 million acres of peatland and this should be enough land for a wide variety of uses, including energy production.
- After harvesting, peatlands could be converted to farm or timberland.
- After harvesting, some peatlands could be converted to lakes.
- Peatlands are considered a "wasteland" by many people. Only "swamp freaks" and a few others (hunters, trappers) use peatlands today.
- Some peat processing techniques lead to great quantities of dust in the atmosphere.

4. One thing I would like to know more about is:
5. Which was most important to you in making your decision: environment, economic, or social issues? Give your reasons.

RE/SOURCES

- Boffey, P. N., 1975. Energy: Plan to use peat as fuel stirs concern in Minnesota. *Science* 190: 1066-1970 December 12.
- Carter, J. E., 1976. Peat in Minnesota: An assessment. Minnesota Energy Agency, 740 American Center Building, 150 East Kellogg Boulevard, St. Paul, Minnesota 55101.
- Haber-Schaim, U., J. B. Cross, G. L. Abegg, J. H. Dodge and J. A. Walter, 1972. Introductory physical science, second edition, Prentice-Hall, Inc., Englewood Cliffs
- Hozza, D. D., 1977. Peat . . . for man's sake. The Minnesota Volunteer January-February pp. 16-21.
- Millhone, J. P., Director. 1976. Minnesota's Energy Situation: A Biennial Report to the Governor and the Legislature. Minnesota Energy Agency, 740 American Center Building, 150 East Kellogg Boulevard, St. Paul, Minnesota 55101.

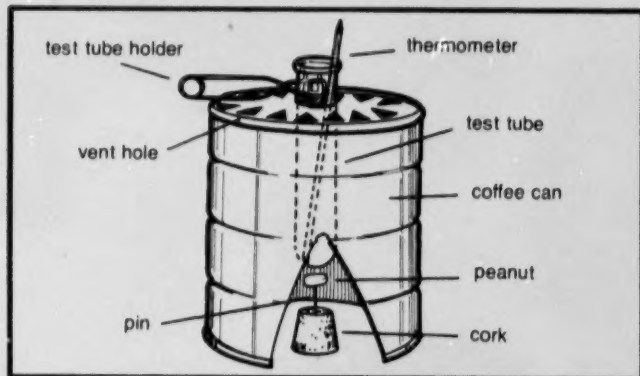
E/VALU/ATION

1. Rank the following in order of their importance to you: One (1) is the most important and eight (8) is the least important:
 - clean water
 - trees
 - mosquitos
 - a warm house/apartment/ place to live
 - fish
 - wildlife
 - growing plants
 - using energy wisely/carefully
2. The hardest part of this activity was:
3. One thing I learned from doing this was:

DATA SHEET FOR PEAT'S SAKE OPTION 1

Peat Heat

Put the apparatus shown in the drawing below together.



You will need to record some information. After you read the instructions below construct a chart to help you keep your information straight.

Instructions

a.) Pour 10 ml of water into a test tube. Take the water temperature. Be sure you take the thermometer out of the water after you take the temperature.

b.) Shell a peanut and weigh it. It should weigh between 0.20 to 0.30 grams. Small samples are necessary because large sizes may cause the water to boil. If the water boils before the sample completely burns, it is impossible to know the amount of heat transferred.

c.) The shelled **peanut** should be placed firmly on the needle. Make sure that the needle is held securely in the cork. Place the cork on a tile plate unless you are working on a non-combustible laboratory surface.

d.) Use a match to start the peanut burning. Put the burning peanut under the test tube as quickly as you can. Do not get your face over the top of the test tube and do not point the test tube at anyone. Be

sure that the peanut burns completely. When the flame goes out, take the temperature. Remove the thermometer. Calculate the gain in temperature. Do this experiment two or three times and compare the results.

e.) Now do this for peat and wood. Do not use pieces which weigh more than the peanut you tested. Hold the peat on a wire screen and tripod or in a tin can lid, so that you can burn it. Do this two or three times for each material used and record your information in a table which includes the name of the material burned, its weight (mass), the water volume, the beginning temperature and the ending temperature.

f.) If you want to get fancy, subtract the beginning water temperature from the ending water temperature (in $^{\circ}\text{C}$) and multiply this number by the volume of water (in mls) to obtain the amount of heat energy (gram-calories) absorbed by the water. There are 1000 gram-calories in one food calorie. The food calorie is always capitalized (C); gram-calories are designated by a small c.

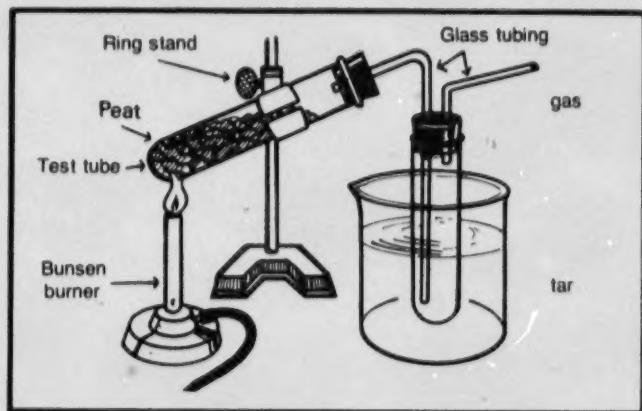
Questions

1. What have you learned about peat as a fuel which could be burned?
2. How does peat compare with other materials as a heat source?
3. What effects does the position of the flame have on the transfer of heat to the water?
4. What is the purpose of the tin can? Is there some way you could prove it? Try it.
5. What is the reason that you do not try to set fire to the peanut while it is under the test tube?

DATA SHEET FOR PEAT'S SAKE OPTION 2

Syngas

Fill a test tube about half full of dry peat and connect the apparatus as shown below. After you have the apparatus together heat the test tube vigorously for 5 to 10 minutes with a bunsen flame. This should be done under a chemical laboratory hood or in a well-ventilated room.



Questions

1. Record what happens in as much detail as you can.
2. Can the gas coming from the condensing tube be ignited?
3. How well does it burn?
4. What evidence is there that gases, liquids and solids were produced?
5. What is the purpose of the condensing tube?
6. When you are finished remove the solid material left in the distilling tube. Try to decide what it is.



DATA SHEET FOR PEAT'S SAKE OPTION 3

You intend to voice your opinions on the use of peat for energy at a public hearing in your community. Using the information below mark each statement with a plus (+) or minus (-) to show whether you think it is a positive or negative influence on producing power from peat. If a statement seems neither positive nor negative, mark it with an "n" (neither). As you go through the list, also label each statement to show the major area affected by the statement. Use "en" for environment, "ec" for economic, and "s" for social.

THE STATEMENTS

- _____ Canada will cut off oil and natural gas supplies to Minnesota in the 1980's.
- _____ There will be a steady reduction in natural gas supplies to Minnesota from the southwest United States during the next ten years.
- _____ The major peat harvesting areas are in northern Minnesota. They are flat, swampy and filled with mosquitos.
- _____ Peat, when it is burned, contributes very little to air pollution.
- _____ Minnesota has no major fossil fuel energy resources such as coal, oil or natural gas of its own.
- _____ Synthetic natural gas produced from peat could be used in taconite mining.

- _____ Synthetic natural gas produced from peat could be used in the food processing industry.
- _____ Peat harvesting could lower the surface of the land 10 to 20 feet.
- _____ Peat harvesting could lead to a reduction of water quality and flooding in northern Minnesota.
- _____ Peat harvesting might affect fish and wildlife.
- _____ Most of Minnesota's peat is on state-owned land.
- _____ A large peat harvesting operation could employ 3,000-4,000 workers for harvesting, handling and processing.
- _____ Peat harvesting is only practical in the summer.
- _____ A synthetic natural gas producing peat industry might employ 1,000 workers year around.



- _____ A synthetic natural gas producing peat plant would require huge areas to supply and fuel a power plant (100,000 acres).
- _____ The supply of synthetic natural gas from 200,000 acres would last for 20 years.
- _____ There are more than 7 million acres of peatland and this should be enough land for a wide variety of uses, including energy production.
- _____ After harvesting, peatlands could be converted to lakes.
- _____ Peatlands are considered a "wasteland" by many people. Only "swamp freaks" and a few others (hunters, trappers) use peatlands today.
- _____ Some peat processing techniques lead to great quantities of dust in the atmosphere.

When you are through, tally your responses and use this information to write a statement you plan to make at the community hearing on the use of peat as an energy resource which begins: "I urge you to"

The Energy Materials and Student Outcomes

These energy learning activities for junior high students match many of the social studies student outcomes found in "Some Essential Learner Outcomes for Social Studies," Minnesota Department of Education.

Forces such as declining enrollments, inflation and an interest in test scores have suggested to many social studies educators that they re-examine what social studies is and why it is important for students. Renewal of social studies programs requires the identification and classification of strands of knowledge, skills and attitudes that District social studies educators agree upon and to which they commit themselves to teaching.

A process for selecting student outcomes is available. Write:

Social Studies Consultant
Minnesota Department of Education
640 Capitol Square Building
550 Cedar Street
St. Paul, Minnesota 55101

PURPOSE . . . To help focus the social studies on the energy situation, a real social dilemma, by contributing to the student's knowledge about the relationships between humans and their social and physical environments; to suggest ways to solve problems and clarify issues; to examine personal beliefs and values; and to recognize the relationships between beliefs, values and individual behavior.

WHAT . . . Seven teacher initiated activities of varying length - one promotes cooperation between social studies and science - student worksheets provided where needed - all have background and instructions - evaluation questions emphasize sharing beliefs and values.

ON VALUES . . . Students should always have the right to pass; all answers are acceptable (not right or wrong); leaders should participate but should be willing to pass at the beginning so students learn to respond freely and not try to "guess the right answer." Sure, you (and students) can correct errors of fact.

Energy Materials Task Force

Richard Clark
Science Coordinator
Department of Education

John Comstock
Evaluation Consultant
Department of Education

Roger Grosslein
Environmental Education Specialist
Department of Natural Resources

Ed Hessler
Minnesota Environmental Sciences Foundation, Inc.

Susanne Hollingsworth
Education Program Coordinator
Minnesota Energy Agency

Karen Loechler
Acting Director
Minnesota Environmental Education Board

John Miller
Environmental Education Coordinator
Department of Education

Joe Premo
Consultant-In-Science
Minneapolis Public Schools

Bill Schmidt
Environmental Education Coordinator
Department of Natural Resources

Roger Wangen
Social Studies Consultant
Department of Education

WRITERS

David Beaver, Robbinsdale Schools

Virginia Berg, St. Mark's School, St. Paul

Carmen Borgerding, Southeast Regional
Environmental Education Coordinator

John Brady, Northfield Schools

Chuck Carpenter, Albert Lea Schools

Energy Materials Task Force (Cont.)

John Coulter, St. Cloud State University

Dan Eckberg, Hopkins Schools

Gary Engstrom, Minneapolis Schools

Norm Knutilla, Grand Rapids Schools

Greg Leifeman, Staples Schools

Kathy Murphy, Mounds View Schools

Ron Salladay, Grand Rapids Schools

TRIALERS:

Thanks to the students and teachers who trialed these materials. Their candid evaluations contributed to the improvement of the materials.

A cooperative project of the Minnesota Energy Agency and the Minnesota Department of Education.

April, 1977